

Claims:

Sub  
a5  
1. An optical structure for processing optical energy comprising a metal layer having a first surface comprising a plurality of voids having a dimension less <sup>than</sup> ~~that~~ the wavelength of optical energy being processed.

Sub  
C1  
> 2. The structure of Claim 1 wherein said voids are concave and indentations.

10 3. The structure of Claim 1 wherein said voids extend from the first surface to a second surface of said metal layer.

4. The structure of Claim 3 wherein said voids are cylindrical holes passing through said metal layer.

15 5. The structure of Claim 4 wherein said voids have a diameter of from about 10nm to about 1 micron.

20 6. The structure of Claim 1 wherein said voids are arranged in an ordered array.

7. The structure of claim 6 wherein said voids are arranged in a triangular array.

25 8. The structure of Claim 7 wherein said voids arranged in an ordered array produce a phase matched effect.

9. The structure of Claim 1 wherein said metal layer is greater than 50nm thick.

Sub  
a6  
30 10. The structure of Claim 1 wherein an active material placed adjacent the voids.

96  
Conc'd

11. The structure of Claim 1 wherein an active material is placed inside said voids.

12. The structure of Claim 1 wherein said gain layer is placed  
5 on top of said metal layer.

13. The structure of Claim 1 further comprising one or more gain layers placed between a substrate and said metal layer.

10  
14. The structure of Claim 1 wherein a non-linear material is placed adjacent the voids.

Sub  
97  
15  
15. The structure of Claim 1 wherein a non-linear material is placed at least partially in the voids.

16. The structure of Claim 15 wherein the non-linear material fills the voids.

Sub  
98  
20  
17. The structure of Claim 1 which is in the form of a laser, an LED, a wavelength converter, a sensor or a switch.

Sub  
99  
25  
18. A method for optical processes comprising directing optical energy at a first surface of a metal layer, said surface comprising one or more voids having a dimension less than the wavelength of the optical energy being processed.

Sub  
C1  
30  
19. The method of Claim 18 wherein the voids are formed in the first surface of the metal layer in an ordered array.

20. The method of Claim 18 wherein the voids are filled with a gain material.

C1  
cont'd

21. The method of claim 18 wherein the gain material is placed adjacent the voids.

5 22. The method of Claim 18 using a gain layer placed in between a substrate layer and a metal layer.

23. The method of Claim 18 wherein the voids are filled with a non-linear material.

10

24. The method of claim 18 wherein the non-linear material is placed adjacent the voids.

15

25. The method of Claim 18 using a non-linear material placed in between a substrate layer and a metal layer.

26. The method of Claim 18 further comprising optical pumping.

20

27. The method of Claim 18 further comprising phase matching to form optical second harmonic generation.

Sub  
29

25

28. A laser comprising a metal layer having first surface comprising a plurality of voids, said voids having a dimension less than the wavelength of optical energy being processed.

30

29. An LED structure comprising a metal layer having a first surface comprising a plurality of voids, said voids having a dimension less than the wavelength of optical energy being processed.

add  
a'10